

Is your Beam really headed North?

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Any Ham who puts up a beam, will be looking for the most accurate installation possible. One will naturally refer to a compass. But one should not forget that some corrections must be brought up to a compass reading, because the magnetic north is not coincident with the geodesic north. And the metallic structure of a high rise building for example could induce quite an error on a compass reading.

In front of the Quebec Parliament building, some 100 metres north of the central door, there is a solar clock (see Fig.1).

This 'monument' is dedicated to the Surveyors of Canada, and it was built in 1967, by the Architect J.C. Tardif from Sherbrooke. This is also a geodesic point situated exactly at a Latitude of 46 degrees 48 minutes 35.39 seconds north, and a Longitude of 71 degrees 12 minutes and 50.72 seconds west, and an altitude of 77.11 metres above mean sea level.

I first thought that at noon its shadow should point directly north. I adjusted my watch very accurately and went for my first observation to check on my theory. It did not work that easily. Well, I thought, maybe I have to consider daylight saving time, or UTC and of course the longitude has to do with the position of the sun at noon because as the earth rotates 360 degrees in 24 hours, the sun moves 15 degrees in one hour. Which means that our real noon should be 4 hours later than Greenwich, for the first 60 degrees, plus $12^{\circ}50.72''/15$ of the next hour, which gives me 16 h 44 min and 51.5 s (UTC). After further observations of the noon shadow I compiled timings between 16 h 28 min 30 s and 16 h 59 min and 06 s (UTC), varying from day to day.

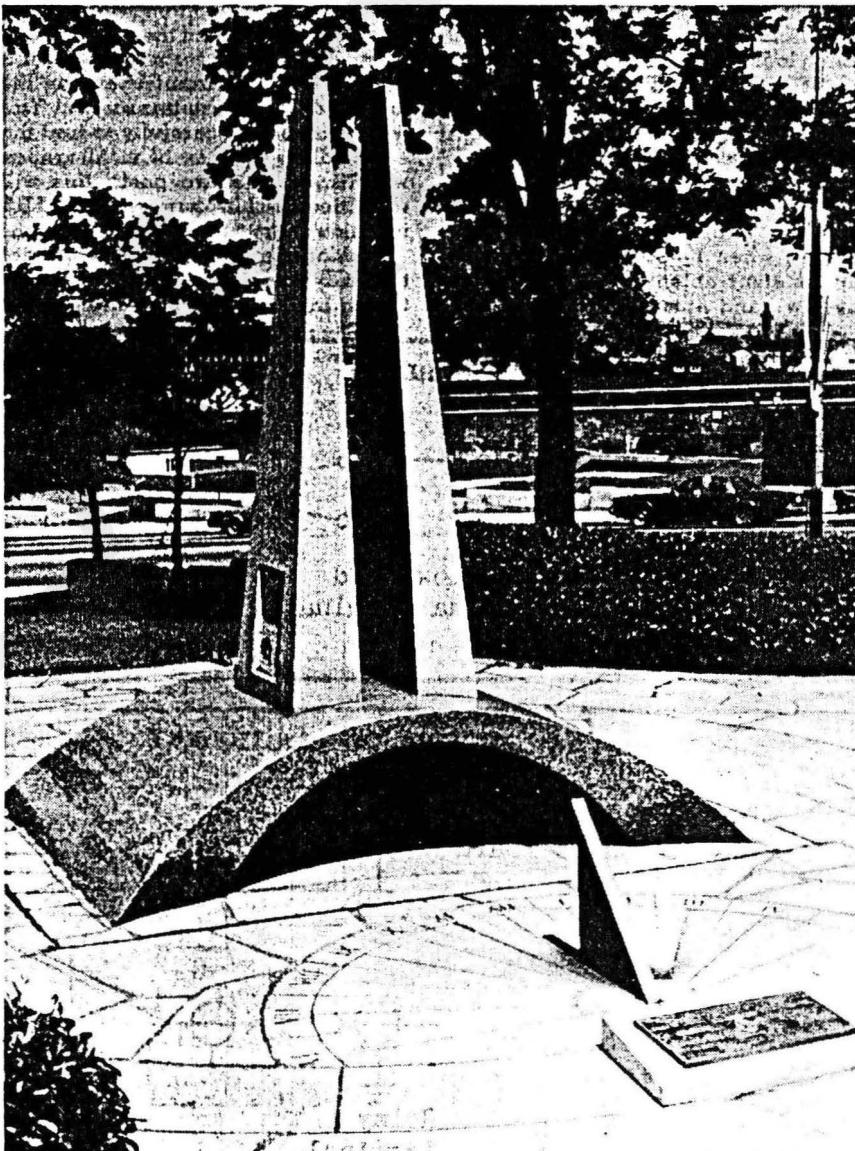
I was wondering where this variation could come from, and nobody around me could help. After a few months of research, I found the answer in a book of 'Physical

Geography' written by Mr. Arthur N. Strahler, Professor of Geomorphology, Columbia University.

Let's mention briefly the explanations that I found.

The earth is travelling around the

sun in an elliptic orbit, and its speed varies from day to day. On June 21 we are 94,500,000 miles from the sun while on Dec. 21 we are at 91,500,000 miles away. The earth averages a speed of 66,000 miles an hour, and



Monument and solar clock, some 100 metres North of the main door of the Quebec parliament building.

the maximum speed is on Jan. 4 (perihelion), while the minimum speed takes place on July 4 (aphelion). A point that intrigued me much is the fact that if Quebec is at noon on June 21, after travelling 180 degrees (6 months) around the sun, on Dec. 21 the noon point looking at the sun, should be at midnight. Otherwise the rotation would have to gain half a turn or 12 hours each six months??? The explanation to this situation, is that the sidereal day (looking at the earth from the Polar Star) is really 23 hours 56 minutes and 4.09 seconds.

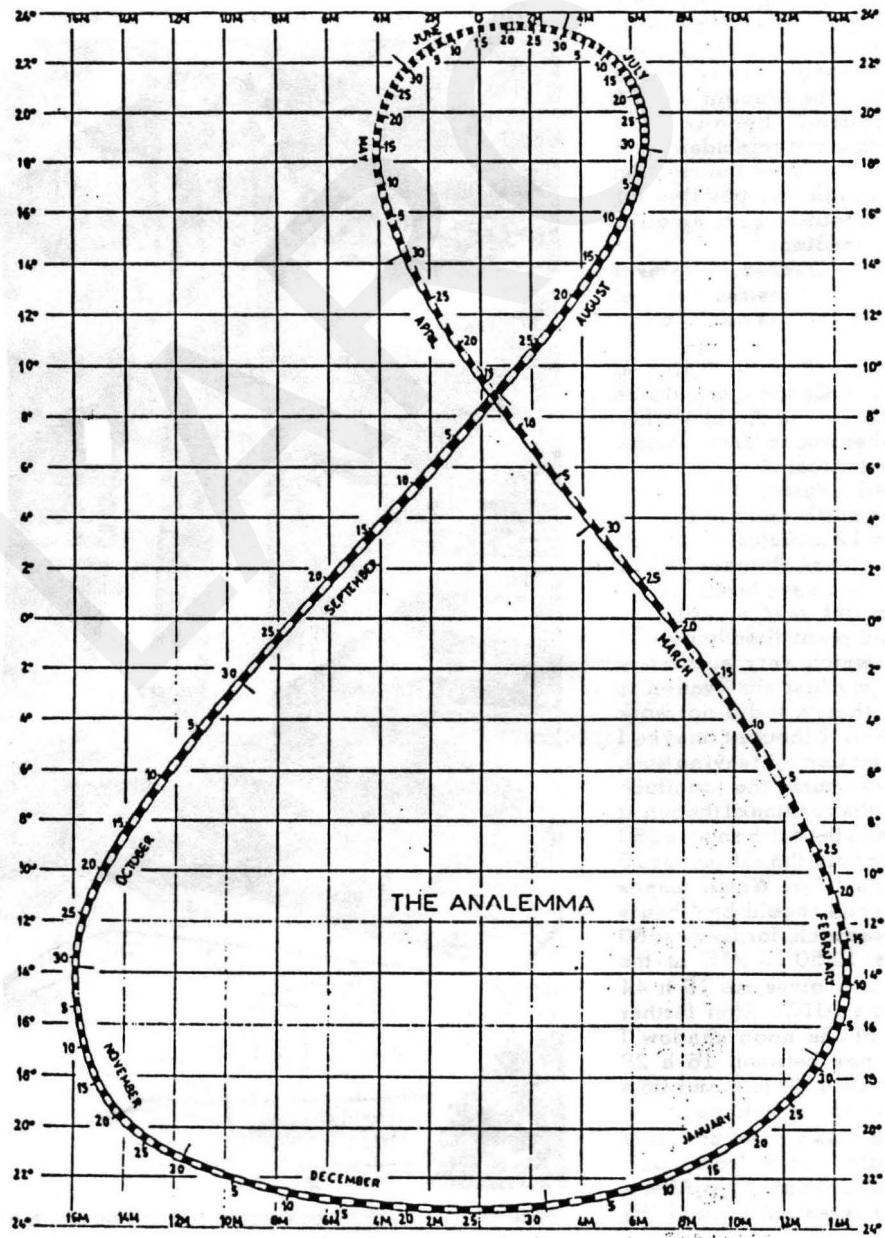
Based on the above facts, how can we figure the daily correction to noon time? Well, on most globes, there is a

graph shaped as an 8, called the analemma, which will give us the equation of time for each day, together with the declination of the sun (23.5 degrees north on June 21, and 23.5 degrees south on Dec. 21). Knowing this correction it is easy to situate exactly the north which is pointed by any vertical shadow at the real noon time, provided that we have a clear sky (Figure, pg. 44).

For example, my QTH, according to a military map, is situated at 71 degrees 14 minutes and 43 seconds west (the smart ones will say that I live only 2 minutes away from the Parliament building). If we transpose the minute-second in decimal figures,

we are exactly 71.25 degrees west (or very close) which means that the sideral noon here is at 16 h and 45 min and 00 s (UTC) plus or minus the daily correction. On July 25 the real noon will be 16 h 51 min and 30 s, on Nov. 5, the reading should be taken at 16 h 28 min and 30 s (UTC), on Dec. 26, Sept. 2, April 16, and June 15 according to the analemma there is no correction.

From the above calculation, I had to correct the orientation of the beam many degrees from the original setting, which is negligible when the radio conditions are good, but could make the difference in making a QSO or not if the conditions are bad.



The Analemma tells you where the sun will be at noon any day of the year. The vertical scale tells you the sun's altitude above or below the equator; the horizontal, however, shows the sun's position relative to standard time.